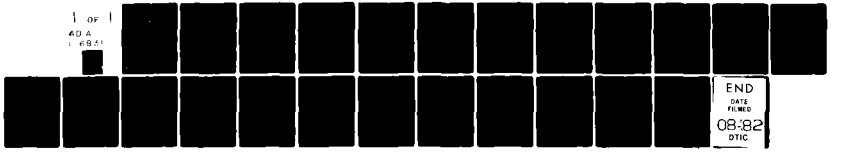
AD-A116 831 NAVAL AIR DEVELOPMENT CENTER WARMINSTER PA AIRCRAFT --ETC F/G 15/5
SURVEY AND UPDATE OF F-14A MISSION PROFILES FOR TF30 ENGINE USA--ETC(U)
APR 82 S M COTE

UNCLASSIFIED NADC-82093-60 NL



(12)

REPORT NO. NADC-82093-60

SURVEY AND UPDATE OF F-14A MISSION PROFILES FOR TF30 ENGINE USAGE

S. M. Cote
Aircraft and Crew Systems Technology Directorate
NAVAL AIR DEVELOPMENT CENTER
Warminster, PA 18974

30 APRIL 1982

FINAL REPORT
TASK AREA NO. W13550000
Work Unit No. EM912

APPROVED FOR PUBLIC RELEASE. DISTRIBUTION UNLIMITED

Prepared for
NAVAL AIR SYSTEMS COMMAND
Department of the Navy
Washington, DC 20361

82 07 [illegible] 11

N O T I C E S

REPORT NUMBERING SYSTEM - The numbering of technical project reports issued by the Naval Air Development Center is arranged for specific identification purposes. Each number consists of the Center acronym, the calendar year in which the number was assigned, the sequence number of the report within the specific calendar year, and the official 2-digit correspondence code of the Command Office or the Functional Directorate responsible for the report. For example: Report No. NADC-78015-20 indicates the fifteenth Center report for the year 1978, and prepared by the Systems Directorate. The numerical codes are as follows:

CODE	OFFICE OR DIRECTORATE
00	Commander, Naval Air Development Center
01	Technical Director, Naval Air Development Center
02	Comptroller
10	Directorate Command Projects
20	Systems Directorate
30	Sensors & Avionics Technology Directorate
40	Communication & Navigation Technology Directorate
50	Software Computer Directorate
60	Aircraft & Crew Systems Technology Directorate
70	Planning Assessment Resources
80	Engineering Support Group

PRODUCT ENDORSEMENT - The discussion or instructions concerning commercial products herein do not constitute an endorsement by the Government nor do they convey or imply the license or right to use such products.

APPROVED BY: _____ DATE: 4/28/82

J. R. WOODS
CDR USN

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: NADC-82093-60	2. GOVT ACCESSION NO.: AD-A116 831
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): Survey and Update of F-14A Mission Profiles for TF30 Engine Usage	5. TYPE OF REPORT & PERIOD COVERED: Final Report
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): S. M. Cote	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Naval Air Development Center, Warminster, PA 18974	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: P.E. 64268N; W.U. No. EM912; T.A. No. WI3550000
11. CONTROLLING OFFICE NAME AND ADDRESS: Naval Air Systems Command, Jefferson Plaza, AIR-5360C, Washington, DC 20361	12. REPORT DATE
	13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Duty Cycle
Gas Turbine
Mission Profile
Engine Usage

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The mission profiles and maintenance procedures relating to the TF30-P-412 engines have been investigated to find out whether an observed reduction in engine usage was due to different aircraft missions or new flight procedures. A survey of fleet squadron personnel revealed mission profiles are essentially the same; however, fewer air combat engagements and landing practices account for the lower usage. The F-14 role is now more evenly distributed between air combat and intercepts, while the total number of these missions remains

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-LF-014-6601

(Continued on back)

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

constant. A future advanced technology engine in this aircraft is likely to encounter higher usage requirements if there are no throttle cycle restrictions.

SUMMARY

The mission profiles and maintenance procedures relating to the TF30-P-412 engines have been investigated to find out whether an observed reduction in engine usage was due to different aircraft missions or new flight procedures. A survey of fleet squadron personnel revealed mission profiles are essentially the same; however fewer air combat engagements and landing practices account for the lower usage. The F-14A role is now more evenly distributed between air combat and intercepts, while the total number of these missions remains constant. A future advanced technology engine in this aircraft is likely to encounter higher usage requirements if there are no throttle cycle restrictions.

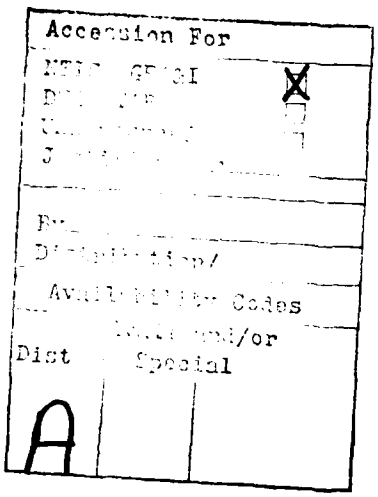


TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION AND OBJECTIVE

The first thorough fleet survey of the F-14A fighter community was performed in 1977 in conjunction with an effort to determine fighter and attack training missions as well as establishing a duty cycle that would be used for the F404 engine development test criteria. Results from that survey were reported in reference (a).

Reference (b) tasked this Center to examine and update the F-14A mission profiles for anticipated higher (or lower) consumption of TF30 engine spare parts. Specific components such as the combustor and high pressure turbine have been redesigned to yield longer lives. Any change in engine usage can affect these lives, and the peacetime missions will provide the understanding of that change.

In addition, the Advanced Technology Engine Studies (ATES) reference (c), are investigating conceptual designs for the F-14A replacement aircraft. These systems must balance performance and durability requirements to yield the lowest cost. Approximately 40% of current fighter propulsion system life cycle costs (exclusive of fuel costs) are predominantly due to repair of hot section parts. Gas turbine components have exhibited very short lives when designed to an inaccurate duty cycle. Therefore, the duty cycle has to be fully understood so that it may be factored into the design process and prevent excess component life consumption.

2.0 BACKGROUND

The primary objective in 1977 was to identify and define those flight procedures used in the fighter role, more specifically the training missions. From those interviews a group of seven mission profiles shown in figures 1-7 were constructed. They contained actual flight training procedures used by Naval fighter squadron pilots who operate the F-14A/TF30 weapon system. A test aircraft was flown on these missions with the subsequent engine usage forming the basis of the 1977 TF30 duty cycle. These data were sent via reference (d) to Pratt & Whitney and they calculated the low cycle fatigue (LCF) life for the TF30 engine components.

In 1979, an LCF program was begun by NATC to count throttle cycles on fighter aircraft, in particular the F-14A/TF30. At the same time, a Fleet Fighter Loads Survey (FFLS) was sampling some engine data from four aircraft in two west coast squadrons (VF51 and VF111). Data from these two sources as well as the 1977 survey are shown in Table I.

TABLE I. F-14A Engine Usage Comparison

Source	Throttle Cycles	Starts	Hot Time (hrs.)
1977 Survey	7211	633	169
1979 FFLS	4201	638	107
1979 LCF	2690	584	90

These statistics are based on 1000 hours of engine operating time. The principal difference between the original data and the 1979 data is a decrease in hot time and throttle cycles. It is believed that the LCF data is more representative because it was sampled from six squadrons on each coast. However, these reductions suggest different operating procedures within the mission profiles presently flown in the F-14A. It is equally possible that a different threat and new role has been initiated for the F-14A.

3.0 METHODOLOLGY

An intensive survey of F-14A squadrons was performed (from December 1981 to February 1982) to elicit details regarding their current mission profiles and standard operating procedures used in-flight. The following topics were discussed during each visit to NAS Miramar and NAS Oceana: mission or flight profiles, maintenance check flights, ground trim runs, sortie frequency (mix), aircraft configuration, store loading, tactical postures, NATOPS procedures and restrictions, etc.

Each squadron and their respective powerplant maintenance shop provided officers and enlisted personnel in support of the survey. They answered questions freely and discussed topics to any degree required by the interview.

The replacement air group (RAG) squadron was also visited, primarily for the purpose of discussing pilot training. Here the new aviator gets his first introduction to the basic flying qualities of the F-14A and finishes out his formal training in air combat and carrier landings. His skills are generally increased afterward during later assignments to operational squadrons. The RAG has a defined syllabus of sorties which was obtained. Table II lists the squadrons by each location with the RAG heading each group.

TABLE II. Fighter Squadrons Visited by Location

NAS Miramar, CA	NAS Oceana, VA
VF 124	VF 101
VF 51	VF 33
VF 111	VF 41
VF 114	VF 84
VF 213	VF 102

4.0 DISCUSSION OF SURVEY RESULTS

Mission profiles of the F-14A training syllabus have not changes in content or number according to instructor pilots at both VF 124 and VF 101. The missions flown in operational squadrons have not changed either, except different names are used now compared to those identified in the 1977

survey. Table III lists the 1977 survey profile categories and similar profile categories from the recent survey side by side. Although several categories have different names, most pilots agree that the basic profile is similar and the objective of the sortie or the threat is no different than before. For this reason, it was initially concluded that for the same profile, different procedures must be taking place to account for the observed reduction in usage.

TABLE III. TF30 Mission Profile Category Comparison

1977 Profile Category	1981 Profile Category
Familiarization	Service
Instruments	Low Level Navigation (LLN)
Conventional Weapons	Gunnery (GUN)
Air Combat Maneuvers	Air Combat Maneuvers (ACM)
Fight Intercept	Air Intercept Control (AIC)
Field Carrier Landing Practice	Field Carrier Landing Practice (FCLP)
Post Maintenance Check Flight	Post Maintenance Check Flight (PMCF)
Combat Air Patrol	Maritime Air Superiority (MAS)
Trim	Trim

Pilots were questioned about the present aircraft configuration, and asked that they separate their responses according to whether they were based on land or deployed on board a carrier. The land-based configuration was given as a clean aircraft plus missile rails. On intercept missions in particular they cited an additional "dummy sidewinder" with no propellant but avionics to support the aircraft radar and fire control systems.

In the case where the squadron was on deployment, pilots related additional stores were carried. A typical loading included two drop tanks and six missiles (usually 2 AIM-54, 2 AIM-7, 2 AIM-9). With this ordnance and fuel, the aircraft gross takeoff weight exceeded 60,000 lbs. and therefore catapult takeoffs were routinely done at maximum A/B thrust reference (e). The extra fuel in the drop tanks was said to reduce the frequency of refueling on a typical CAP mission. Pilots cited how well the TF30 could remain on station using internal fuel, and drop tanks just made the mission that much easier to manage fuel.

Refueling was identified in reference (f) as a major engine usage driver. This is particularly true of all fighter aircraft that must manage to remain aloft for the required carrier cycle time. Hence, the fewer refueling occurances would support the reduced usage shown earlier.

Another segment of the profile that can affect usage was the cruise legs. Generally speaking, in the training mission an aircraft is given a full internal supply of fuel and thus the further a pilot has to go, the less time he has to engage in air to air combat. To measure this effect, pilots were asked to show on a navigation chart exactly where they fly most often. The warning areas cited almost exclusively are shown in figures 8 and 9. These ranges or areas have nearly unlimited altitude and airspeed boundaries. All air to air combat sorties use these areas; fighters from Oceana fly to W-72 and W-386 while fighters at Miramar use W-291.

The 1977 surveyed profiles contain an average time to the practice area of 15-20 minutes. Distances to the midpoint of W-72, 386, and 291 were 90, 120 and 75 nautical miles respectively. Typical cruise speeds were said to be about 300 knots true. With this velocity we can compute an approximate time enroute to each practice area. Table IV contains each time and shows that cruise legs would range from 15-24 minutes. These values agree very closely with those estimated in the 1977 survey. Thus, the cruise segments will continue to allow the same allotment of combat practice as the earlier profiles defined. Also it suggests that the combat segments may be characterized differently now.

TABLE IV. Warning Area Cruise Time Summary

To	From	Time (min.)
W-72	Oceana	18
W-386	Oceana	24
W-291	Miramar	15

Engine usage drivers in combat practice are the length of engagement, the number of engagements and the number of practice landings that can be done at the end of each flight. Similarly, a mission like FCLP is also a driver. Pilots were asked from each squadron interviewed, how many runs or engagements were typically performed. Their response was fairly consistent. Also it was agreed that supersonic intercepts are indeed practiced yet not too frequently - about one in ten.

The 1977 survey data were inspected for combat engagements and landing practice. Table V shows the comparison of both surveys. A significant decrease was observed in both the ACM and FCLP profile. These profiles together were 26% of the 1977 mission mix and contributed most of the throttle cycles shown in Table I. The reason we tend to neglect the increase in engagements cited on the GUN sortie is that maneuvers flown

during gunnery have fewer throttle cycles per engagement and as such result in a much smaller contribution to the usage. For AIC the data was observed to agree with the present pilot estimate. Pilots also cited a reticence for large throttle chops (e.g. A/B to idle) because of the high probability of an engine stall. This reasoning tends to substantiate that the typical ACM sortie does not contain a high number of throttle cycles which would correspondingly reduce the present TF30 usage. It must be mentioned that pilots stated a preference for an engine which did not have this restriction. This implies that an engine like the F101-DFE would be exposed to a usage closer to that shown in Table I for 1977 survey.

TABLE V. Number of Engagements and Landings Compared by Survey Year

Mission Category	1977	1981
ACM	6	3
AIC	6	6
GUN	9	14
FCLP	15	12

The mission mix was derived from squadron records. Several months of data were summed to get a representative mean. The results were then compared to the 1977 survey in Table VI. Then we see more intercept flights and gunnery. Today air combat and landing practice have increased their percentages which overall presents a more even distribution of sorties and flight hours. The sum of ACM & AIC are still very close which suggests that no change to the fighter/intercept role has occured.

TABLE VI. Mission Mix Statistics by Year

Year	ACM	GUN	AIC	FCLP	LLN	PMCF
1977 Survey	16%	10%	45%	10%	19%	3%
1981 Survey	20%	8%	36%	14%	20%	2%

For each squadron visited, time was also spent at the powerplant maintenance shop. Although these people do not fly the aircraft, they can run the engines through an appreciable amount of cycles. Ground runs are placed in either of two categories - "low power turns" or "trims"; a low power turn is running the engine at idle to provide the avionics with electrical power and the "trim" has a definite procedure described in reference (g). Trims spend most of their time at high power especially when trouble shooting the augmentor. Powerplant personnel, cited on a typical A/B check, burner lights were attempted after fuel filter cleaning and flushing a half a dozen times. Almost every squadron related this "pilot gripe", i.e. afterburner failed to light.

Powerplant personnel stated they did a greater number of "turns" than "trims" - about eight to one. Of the two remaining aircraft supporting the FFLS program, one group of recorded tapes contained 66% of engine operating time due to ground runs. The other tapes contain 32% of the time due to ground runs. These statistics are not representative of the entire fighter community, but they do reflect the impressions observed on the recent survey.

During these interviews, the same issues seemed to arise at every squadron:

(1) Pilots repeatedly cited the throttle restrictions currently applied to the TF30 as a definite disadvantage in their tactical scenario. They also pointed out that each RAG teaches (and justifiably) a healthy concern or respect for engine stalls resulting from throttle bursts or chops.

(2) They frequently cited the low thrust to weight ratio of the F-14A adversely affects survivability in ACM and AIC. For equal tactical advantage this power plant requires maximum A/B and the attendant fuel consumption penalty that minimizes the chance to reengage. A/B is required to attain the most favorable firing opportunity during intercepts at high altitudes and thus becomes inconcistent with present techniques for fuel management in the peacetime training regime.

(3) They continually praised the low power fuel consumption while the aircraft maintains it's CAP station. Any future engine will be evaluated using this present capability as the figure of merit. They appreciated this fact yet when questioned about the relative value of fuel consumption or thrust to weight to their tactical posture, the united response was thrust was still the prime ingredient for completing the fleet defense role of intercepting incoming forces.

(4) Pilots often raised the question of engine smoke; because of the smoke trail at dry power they usually select minimum A/B to reduce the aircraft visibility during intercept practice.

5.0 CONCLUSIONS

Comparing the 1977 mission profiles to those obtained on recent visits to NAS Miramar and NAS Oceana, the flight procedures during combat practice have changed significantly while the basic profiles have not.

The mission mix of the F-14A is more evenly distributed between air combat and intercept yet the total number of these missions remains the same.

An observed reduction in TF30 usage is most likely due to the combined effect of a marked reduction in ACM engagements per mission, the attendant throttle restrictions presently used in pilot training, and a lower number of practice landings after flights such as ACM and during FCLP missions.

An implication from the lower engine usage is a correspondingly greater engine life. This means fewer hot section parts will need repair or replacement as well as fewer engine removals for cause (i.e. hot section distress).

We can deduce that any advanced technology engine, e.g. the F101-DFE, would be subjected to a significantly higher usage because of the absence of throttle restrictions. That higher usage should resemble the 1977 survey figures previously shown.

Future advanced technology engines must be designed for the worst engine usage to ensure that component lives are balanced with their performance. The resulting system will therefore meet the threat with an associated tactical advantage and at the same time be available and affordable for the peacetime training environment.

6.0 ACKNOWLEDGEMENT

The author expresses a sincere appreciation to CDR P. Ringwood of COMFITAEWWINGPAC and LT S. Saunders of COMFITWINGLANT, who helped make this survey so successful. I also wish to thank the various squadron pilots and enlisted personnel who volunteered their time to answer questions and explain the details of their jobs.

7.0 REFERENCES

(a) Cote, S. M. and Birkler, J. L., "Simulated Mission Endurance Test (SMET) for an Aircraft Engine to be used in a Fighter/ Attack Role", NAVAIRDEVCEN Report 77501-30, 23 Apr 1979.

(b) "Operational Environment for Aircraft Engines", Airtask 5365360 0012 2W13550000, Work Unit No. 139 Amendment G, 17 Aug 1981.

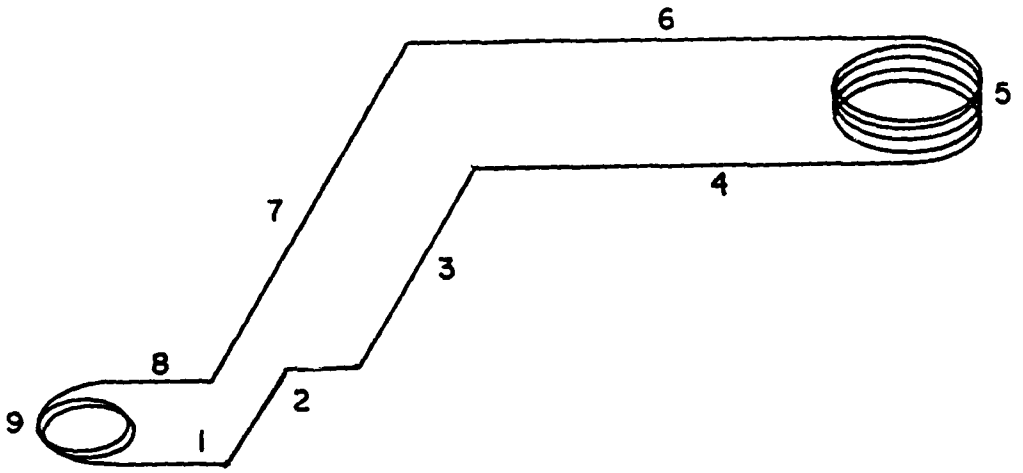
(c) "Advanced Technology Engine Studies (ATES)", Task I and II Final Reports, FR-14592, 12 Jan 1982.

(d) "F-14A/TF30 Mission Profile/Mission Mix for LCF Life Determination", NAVAIRSYSCOM Letter serial 7166, 19 May 1977.

(e) "NATOPS Flight Manual", NAVAIR 01-F14AAA-1, 15 Jan 1980.

(f) Cote, S. M., "Recent Developments in Naval Aircraft Jet Engine Usage", AIAA Paper No. 81-1366, 27-29 Jul 1981.

(g) "Quick Trim Data Cards", NAVAIR-01-F14AAA-2-3-6.1, 15 Jan 1980.



1. 30 MINUTES WARMUP, MAXIMUM A/B TAKEOFF

2. CLIMB TO 2000 FEET AND LEVEL OFF AT INDICATED AIR SPEED OF 325 KNOTS, 3000 POUNDS/HOUR FOR 2 MINUTES

3. CLIMB TO 20,000-40,000 FEET AT MILITARY POWER, MACH = .68

4. CRUISE OUT, PARADE FORMATION, 90% RPM, 2500 POUNDS/HOUR FOR 10-15 MINUTES

5. ACROBATICS - LOOPS, ROLLS, NOSE HIGH RECOVERY ETC. INDICATED AIR SPEED OF 250 KNOTS - MACH = 1.6, 10,000-35,000 FEET MILITARY POWER TO MAXIMUM A/B, TIME DURATION 20-30 MINUTES

6. CRUISE IN AND SLOW DESCENT TO 18,000 FEET, 90% RPM

7. DESCENT IDLE - 85% RPM, INDICATED AIR SPEED OF 250 KNOTS, ALTITUDE 2000 FEET

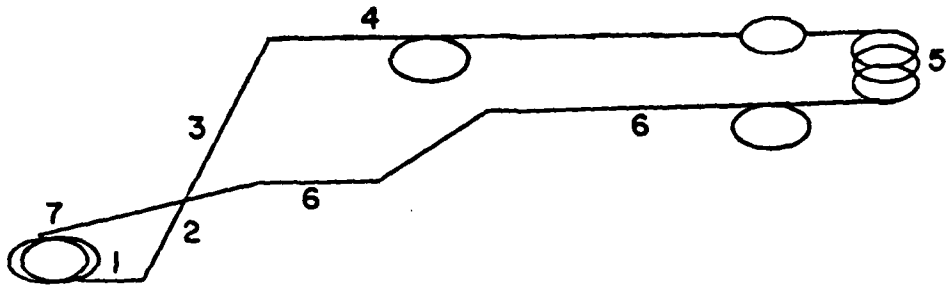
8. APPROACH TO GCA INDICATED AIR SPEED OF 250 KNOTS, 95% RPM, 2-3 MINUTES

9. TOUCH AND GO 3-4 TIMES

10. BRAKE AND LAND

STORES - F14A 2 RACKS

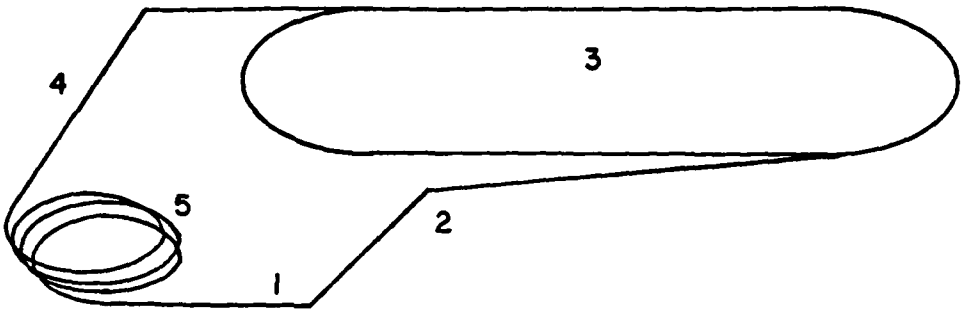
Figure 1. F-14A Familiarization Mission Profile



1. WARMUP 30 MINUTES, FULL A/B TAKEOFF 30 SECONDS
2. CLIMB AT MILITARY POWER TO 2000 FEET AND LEVEL OFF AT 325 KNOTS INDICATED AIR SPEED, 2 MINUTES
3. CLIMB AT MILITARY POWER TO 15,000 FEET, MACH = .68, 5-10 MINUTES
4. RENDEZVOUS AND CRUISE OUT FOR 15 MINUTES, INSTRUMENT CRUISE FOR 15 MINUTES
5. LOITER FOR 15 MINUTES
6. TWO INSTRUMENT APPROACHES FOLLOWED BY TWO GCA's
7. TOUCH AND GO 4-5 TIMES
8. BRAKE AND LAND

STORES - CLEAN F14A

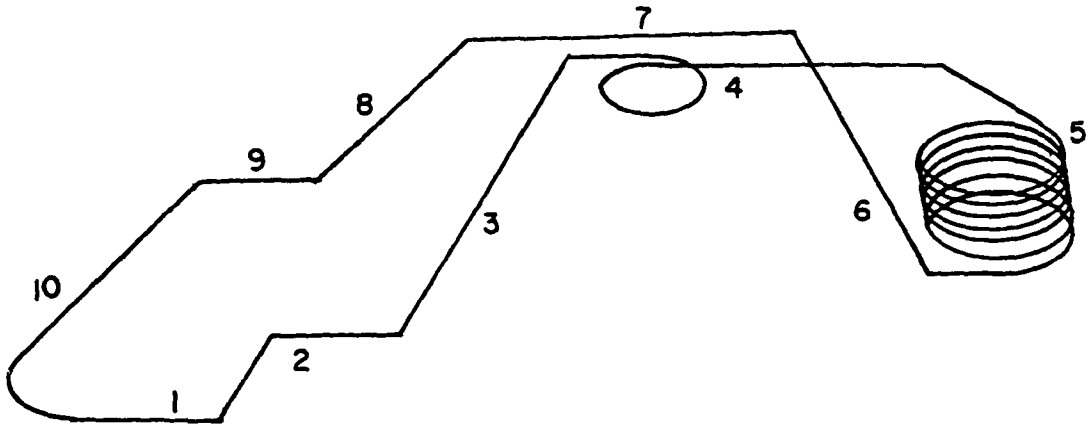
Figure 2. F-14A Instruments Mission Profile



1. WARMUP AT IDLE 30 MINUTES, TAKEOFF MILITARY POWER 30 SECONDS
2. CLIMB TO 600 FEET AND LEVEL OFF
3. LOITER IN PATTERN FOR APPROACH 3-4 MINUTES, 150 KNOTS
4. BRAKE AND DECELERATE FOR TOUCH AND GO, FREQUENT SMALL POWER LEVER CHANGES
5. TOUCH AND GO AT MILITARY POWER 15 TIMES

STORES - F14A 1/2 FUEL LOAD
FULL FLAPS AND GEAR DOWN

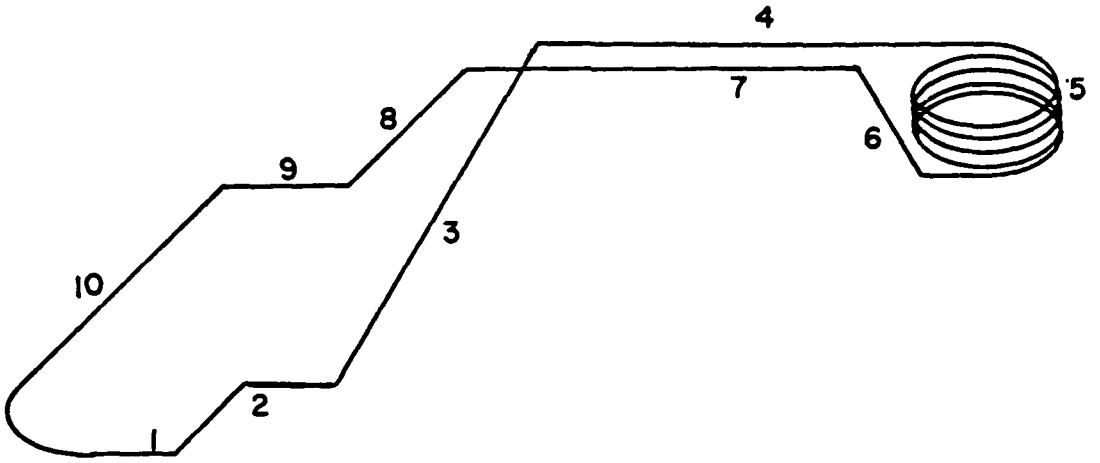
Figure 3. F-14A Landing Practice Mission Profile



1. WARMUP 30 MINUTES, TAKEOFF FULL A/B 30 SECONDS
2. CLIMB TO 2000 FEET, LEVEL OFF AT INDICATED AIR SPEED OF 325 KNOTS FOR 2 MINUTES
3. CLIMB TO 35,000 FEET AT MILITARY POWER, M = .68, 5-10 MINUTES
4. RENDEZVOUS AND CRUISE OUT (COMBAT FORM) FOR 30 MINUTES AT 90%
5. COMBAT BETWEEN 5000-35,000 FEET IN BASIC AIR MANEUVERS FOR 30 MINUTES, POWER RANGE FROM IDLE TO A/B AND INDICATED AIR SPEED OF 450-500 KNOTS
6. CLIMB BACK TO 35,000 FEET AT MILITARY POWER
7. CRUISE IN 25 MINUTES AT 90% RPM
8. IDLE DESCENT TO 11,000 FEET
9. CRUISE IN 5 MINUTES AT 80% RPM
10. IDLE DESCENT TO GCA, INDICATED AIR SPEED 150 KNOTS
11. LAND

STORES - CLEAN F14A

Figure 4. F-14A Air Combat Mission Profile



1. 30 MINUTES WARMUP, MAXIMUM A/B TAKEOFF

2. CLIMB TO 2000 FEET LEVEL OFF AT INDICATED AIR SPEED OF 325 KNOTS FOR 2 MINUTES AT MILITARY POWER

3. CLIMB TO 20000 FEET AT MILITARY POWER, MACH = .68, 5-10 MINUTES DURATION

4. CRUISE OUT (COMBAT FORMATION) 90% POWER LEVER ANGLE, 2500 POUNDS/HOUR, 25 MINUTES DURATION

5. COMBAT (GUNNERY), INDICATED AIR SPEED OF 200-500 KNOTS, IDLE TO MAXIMUM A/B 8-10 TIMES, 15-30 CHANGES IN POWER LEVER ANGLE, BETWEEN 10,000-25,000 FEET 20% BANNER, 80% DART

6. CLIMB BACK TO 20,000 FEET AND LEVEL OFF AT INDICATED AIR SPEED OF 325 KNOTS, 3000 POUNDS/HOUR

7. CRUISE IN 15-20 MINUTES AT 90% POWER LEVER ANGLE

8. IDLE DESCENT TO 11,000 FEET

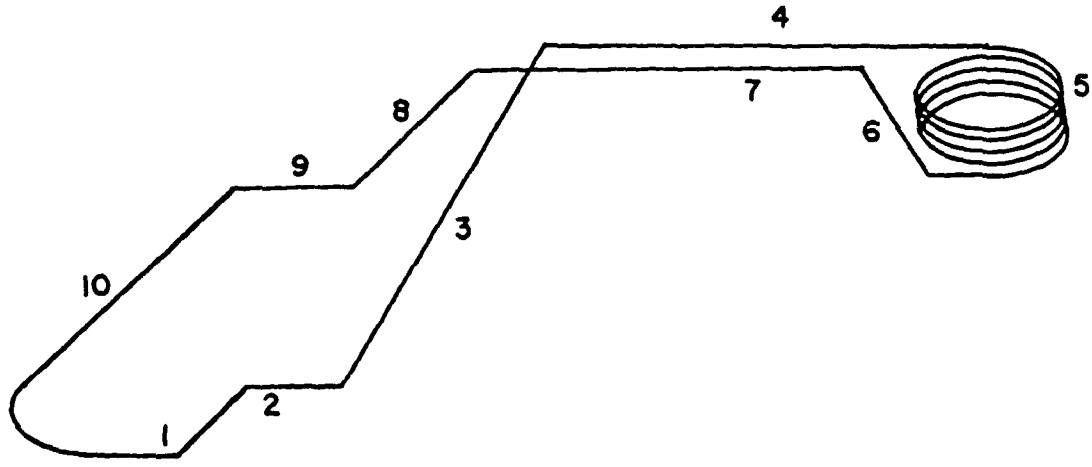
9. CRUISE IN 2-3 MINUTES AT 80% POWER LEVER ANGLE INDICATED AIR SPEED OF 250 KNOTS

10. IDLE DESCENT TO GROUND CONTROL APPROACH (GCA), INDICATED AIR SPEED 150 KNOTS

11. BRAKE AND LAND

STORES - CLEAN F14A

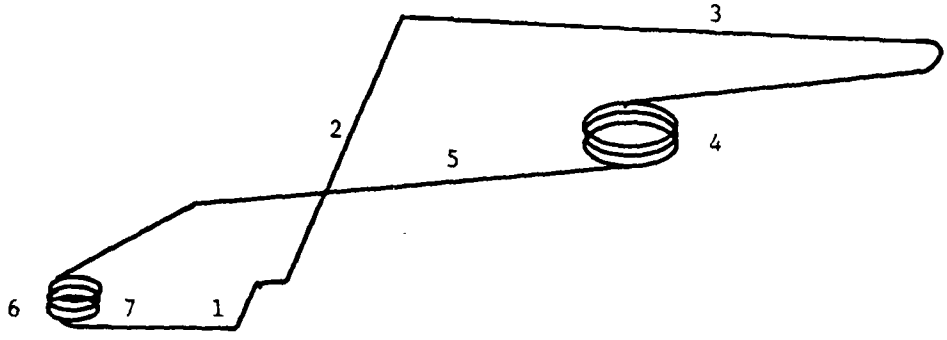
Figure 5. F-14A Conventional Weapons Mission Profile



1. 30 MINUTES WARMUP, MAXIMUM A/B TAKEOFF
2. CLIMB TO 2000 FEET LEVEL OFF AT INDICATED AIR SPEED OF 325 KNOTS 3000 POUNDS/HOUR FOR APPROXIMATELY 2 MINUTES
3. CLIMB TO 30,000 FEET AT MILITARY POWER, M = .68, 5-10 MINUTES
4. CRUISE (COMBAT FORMATION) AT 20,000-40,000 FEET, 90% RPM, 10 MINUTES
5. INTERCEPTS 10,000-30,000 FEET, IDLE - MAXIMUM A/B, 20 MINUTES (HIGH, LOW, AND JINKING BOGIES)
6. CLIMB BACK TO 18,500 FEET AND LEVEL OFF, 3000 POUNDS/HOUR
7. CRUISE-IN AT 90% RPM, 15-20 MINUTES
8. IDLE DESCENT TO 11,000 FEET
9. CRUISE-IN AT 80% RPM, INDICATED AIR SPEED OF 250 KNOTS, 2500 POUNDS/HOUR
10. IDLE DESCENT TO GCA, INDICATED AIR SPEED 150 KNOTS
11. BRAKE AND LAND

STORES - F14A, 2 RACKS, 1 PRACTICE MISSILE

Figure 6. F-14A Intercept Mission Profile



1. WARMUP 30 MINUTES, TAKEOFF MAX A/B 30 SECONDS
2. CLIMB STAGGARED TO 2000 THEN TO 35,000 FEET AT MILITARY POWER WITH AN INDICATED AIRSPEED OF 325 KNOTS
3. DASH OUT AT MACH 1.6 FOR ENGINE PERFORMANCE CHECK AT MAX A/B
4. BASIC MANEUVERS FROM 10-20,000 FEET TO CYCLE ENGINE THROUGH POWER RANGES
5. CRUISE IN AT 80% RPM TO BASE AT LOW ALTITUDE
6. TOUCH AND GO SEVERAL TIMES TO A FINAL APPROACH
7. LAND WITH SEVERAL MINUTES GROUND IDLE

STORES - CLEAN F14A

Figure 7. F-14A Post Maintenance Check Flight

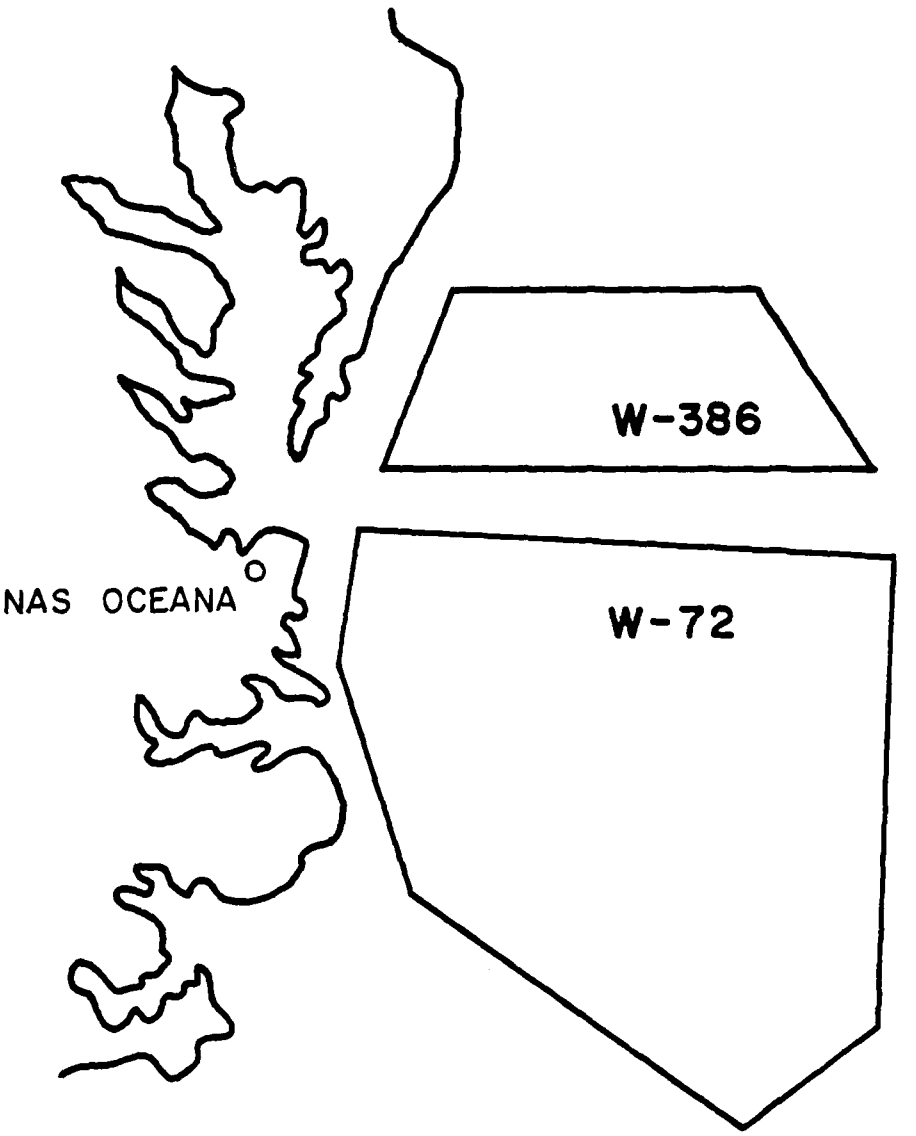


Figure 8. Air to Air Combat Training Areas Near Virginia

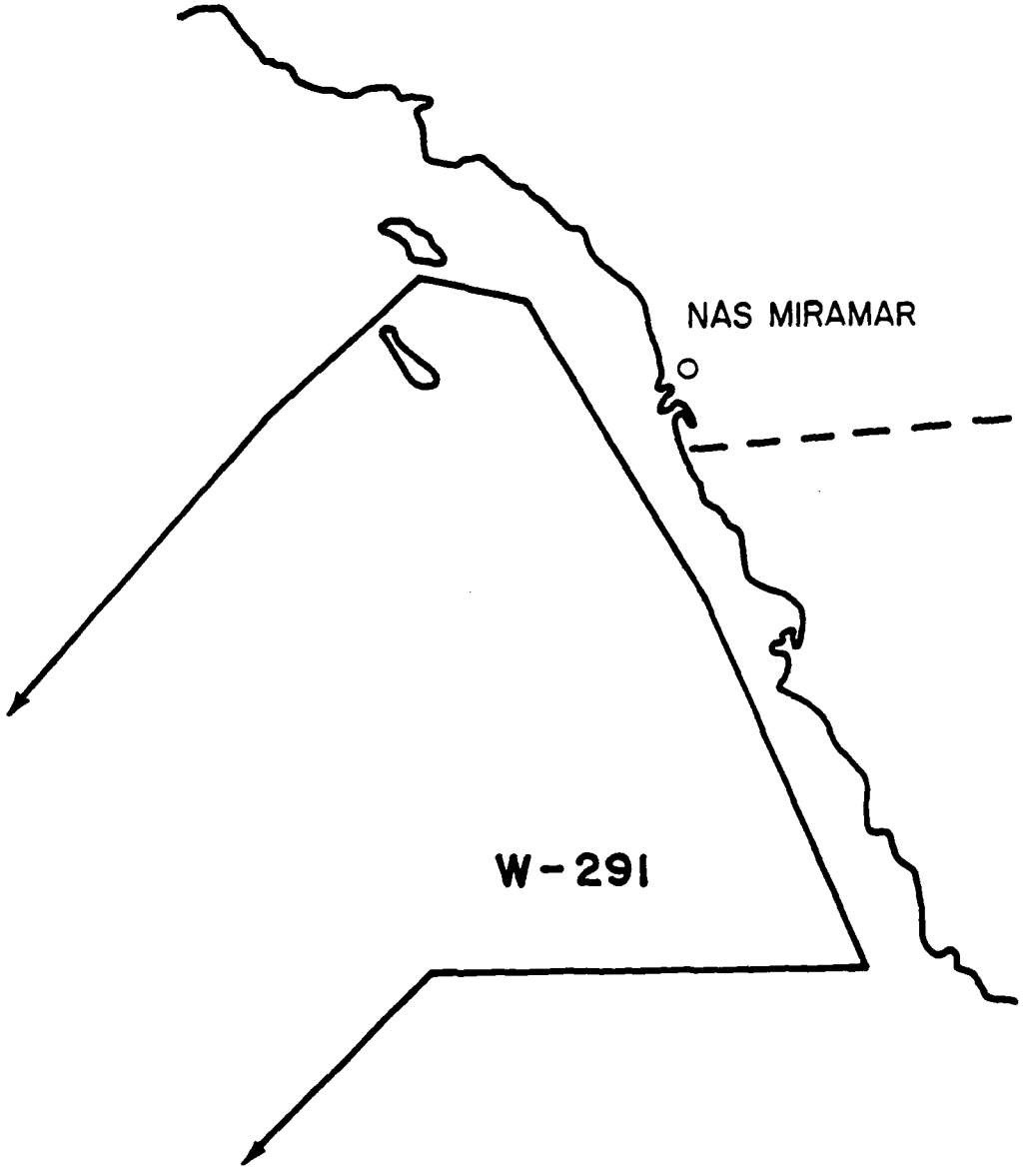
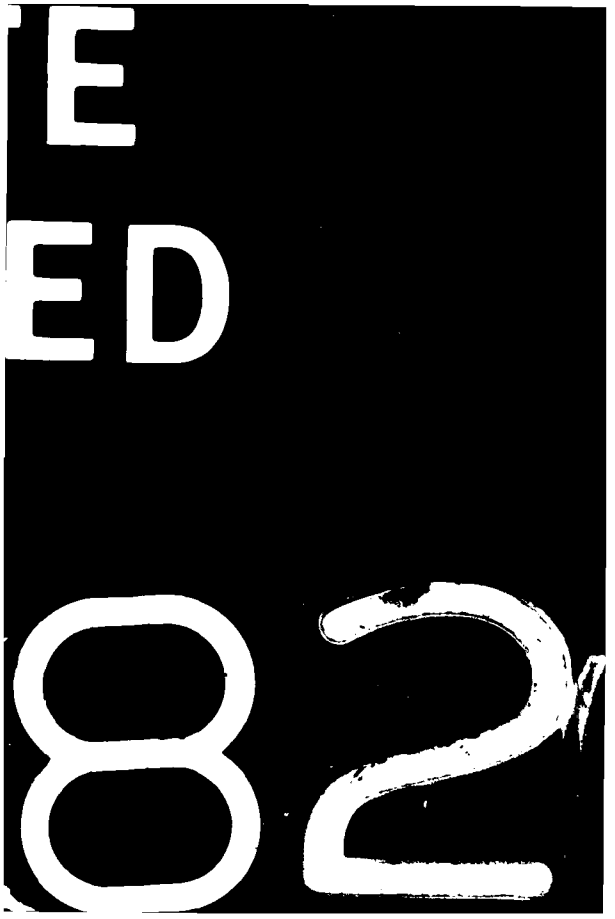


Figure 9. Air to Air Combat Training Areas Near S. California


E
ED
82